TRAFFIC CONES
FOR USE IN
HIGHWAY WORK ZONES

EXECUTIVE LEADERSHIP

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An applied research project submitted to the National Fire Academy
as part of the Executive Fire Officer Program

March 1998

ABSTRACT

Traffic cones were added to the equipment carried on Boca Raton Fire-Rescue vehicles in response to an employee suggestion program. The cones were used sporadically until the Florida Highway Patrol challenged their use on Interstate 95. During subsequent training sessions with the Florida Department of Transportation, it was determined that Fire-Rescue was not using the proper cones and was not using them correctly.

The purpose of this research was to find the applicable standards, review the literature on the subject, and recommend proper equipment and a standard operating procedure for traffic cone deployment. The study used historical and evaluative research methods. The research was able to answer the following questions:

1. What are the specifications for traffic cones on national, state, and local highways?
2. What are the applicable National Fire Protection Association (NFPA) standards?
3. How many traffic cones should be carried on emergency vehicles?

Research was conducted using fire service

publications, Department of Transportation specifications, highway construction and maintenance industry publications, and a survey of selected fire departments throughout the country. This research was the basis for the discussion and recommendations contained in the document.

The specifications for traffic cones and all traffic control devices were found in the Manual on Uniform Traffic Control Devices (MUTCD) from the United States Department of Transportation. The findings show the NFPA has a standard addressing traffic safety located in Chapter 6-4 of the NFPA 1500 Standard which includes traffic cones. The basic question of how many cones should be carried on emergency vehicles is not specified in any standard, but the survey showed an average of five cones per apparatus is common.

The recommendation for Boca Raton Fire-Rescue was to carry five traffic cones on each fire apparatus. However, during the course of the research it was discovered that this was not the real issue that needed to be addressed. The Department must investigate adding more and better early warning devices; then, train personnel in the theory of traffic control and ways to

use the available devices for maximum efficiency, in order to move traffic and protect the public and emergency workers.

TABLE OF CONTENTS

INTRODUCTION

The Boca Raton Fire-Rescue Services carries traffic cones on each fire apparatus. The cones were added at the suggestion of the firefighters for safety reasons but no training was offered for their use. The main problem arose when the use of traffic cones, by Fire-Rescue on Interstate 95, was challenged by the Florida Highway Patrol. Fire-Rescue was then compelled to verify compliance with Department of Transportation (DOT) specifications and create standards for use of these devices.

The purpose of this research is to study the literature available on traffic cones; find the applicable standards from national fire service organizations and national and state departments of transportation; survey other fire departments; and then create a standard operating procedure for placing traffic cones at emergency scenes where equipment and personnel are in close proximity to motor vehicle traffic.

The research will be using historical and evaluative research techniques to study the available literature, analyze the results of a survey of fire departments and answer the following questions:

1. What are the specifications for traffic cones to be used on national, state, and local roadways?
2. What are the applicable National Fire Protection Association (NFPA) Standards?
3. How many traffic cones should be carried on emergency vehicles?

BACKGROUND AND SIGNIFICANCE

Over the last several years the Boca Raton Fire-Rescue Services Department has encouraged an employee suggestion program. This has led to many improvements in equipment, maintenance, procedures and safety. One of those safety suggestions was to carry traffic cones as the telephone and electric utility vehicles carry. This idea was embraced by some, complained about by a few, and given little attention by most personnel. No training or procedures were offered and only one or two cones were put on pumpers with no specific number of cones noted on the apparatus inventory.

In 1996, while working an alarm on Interstate 95 (I-95), a Florida Highway Patrol officer informed Boca Raton Fire-Rescue that, starting in 1997, only Florida

Department of Transportation (DOT) approved cones could be used on State maintained highways and I-95. The Fire-Rescue cones being used at the time were not compliant with DOT specifications. Shortly after that incident, one of the fire department members attended a Florida Department of Transportation (FDOT) training class on setting up highway construction zones which included information on cones and regulations about placing them on roadways. This heightened the awareness as to the need for the proper type and number of traffic cones and a standard procedure for their use.

During the Executive Leadership class at the National Fire Academy, much of the class time was spent discussing leadership styles and the need for each chief fire officer to establish a personal style that he/she can be comfortable with and which can accomplish results for the organization. The challenge in this case is to take a suggestion from the ranks, make it conform to the applicable regulations, make it work effectively for the department, and make sure the credit for the success gets to back to the person who made the suggestion. As stated in the class, this type of action shows an ability to lead, combined with the willingness to accept input and

to give positive reinforcement to subordinates.

This opportunity for leadership has produced the need for this research paper. The research will create a body of information from which a standard operating procedure can be produced that will meet the needs of the department as well encourage other employees to participate in the planning and implementation of standard operating procedures.

LITERATURE REVIEW

The National Fire Protection Association Standard 1500 covers the Health and Safety issues related to the fire service. Within the Standard is Chapter 6-4 which deals with operating at incidents where personnel are exposed to vehicular traffic.

> 6-4.7 When members are operating at an emergency incident and their assignment places them in potential conflict with motor vehicle traffic, they shall wear a garment with fluorescent retroreflective material.
>
> 6-4.7.1 Apparatus shall be utilized as a shield from oncoming traffic wherever possible.

> 6-4.7.2 When acting as a shield, apparatus warning lights shall remain on, and fluorescent and retroreflective warning devices such as traffic cones, illuminated warning devices such as highway flares, or other appropriate warning devices shall be used to warn oncoming traffic of the emergency operations and the hazards to members operating at the incident (NFPA, 1992, pg. 1500-22).

These recommendations give each individual department the ability to specify the type and amount of devices to be used and how they will be set up.

Bruce Teele (1993), wrote the NFPA 1500 Handbook that helps explain the NFPA standard on occupational safety. The book is sprinkled with extra details and explanations about how the standard is to be applied. In the case of safety while operating in close proximity to motor vehicle traffic, Teele says, “The remaining provisions of Section 6-4 are simple and self-explanatory requirements” (Teele, 1993, pg. 346). There is no mention of the type or amount of warning devices. Evidently, Teele feels that the three paragraphs in the standard need no further embellishment.

The Manual on Uniform Traffic Control Devices is the Federal government guide to all traffic signs, barriers, channelization devices, and other roadway markings. Part VI of the manual is the part that deals with traffic controls for highway construction, maintenance, utility, and emergency operations. It defines traffic cones as "devices whose primary function is the chanelization of traffic" (U.S. DOT, 1988, p. 6C4). If the units are to be used at night they must be reflectorized for maximum visibility. The cones must be equipped with, "A minimum 6-inch wide white band placed a minimum of 3 inches but no more than 4 inches from the top. When the 28-inch minimum or larger size cones are used, the standard 6-inch band shall be supplemented with an additional 4-inch white band spaced a minimum of 2 inches below the 6-inch band" (U.S. DOT, 1988, p. 6C4).

The Federal Highway Administration also publishes a smaller manual that deals only with Part VI of the MUTCD. Standards and Guides for Traffic Controls for Street and Highway Construction, Maintenance, Utility and Incident Management Operations goes into more detail and explanation than the MUTCD and can be used as a field handbook for road construction workers setting up work

zones. It too details specifications for cones and cone application. In relation to color, it states, “Cones shall be predominantly orange, fluorescent red-orange, or fluorescent yellow-orange” (U.S. DOT, 1993, p. 62).

Traffic cones are used, among other things, to channelize traffic, and delineate short duration maintenance and utility work. The definition of short duration becomes important to the fire service in making the decision whether outside resources should be called to handle traffic control or if on scene units should allocate manpower to do the job. The manual defines short duration as “activities generally considered to be those in which it takes longer to set up and remove the traffic control zone than to perform the work. Typically, such operations can be accomplished in 60 minutes or less” (U.S. DOT, 1993, p. 96). Simplified control procedures are warranted for short duration activities. These simplified procedures have some basic shortcomings such as lack of early warning and positive guidance to the motorist. These shortcomings may be offset by the use of other dominant devices such as special lighting on fire apparatus.

Traffic cones have been added to the inventories of

many fire apparatus along with the old standard railroad flares. Because these cones are produced in many variations of size and color, the Florida Department of Transportation standards were consulted to determine minimum specifications for traffic cones that were to be used on state maintained roadways and Florida Highway Patrol policed Interstates. The FDOT manual for Traffic Control Through Work Zones contains these specifications:

> Cones shall be 36” in height and weigh 12 pounds. When used at night, cones shall:
>
> Be used only in active work areas.
>
> Be 36 inches tall, with a minimum weight of 12 pounds and be reflectorized as per the MUTCD.
>
> Be used only with Department approved reflective collars. (FDOT, 1994, p. 7)

These specifications provide information that supplements and supersedes the specifications provided by the MUTCD. The FDOT manual specifies the use of cones in tapers. A taper made of cones, spaced a certain distance apart, is the method to channel traffic from one lane into an adjoining lane. The spacing between the cones is variable in relation to the speed of the traffic on the highway. The higher the speed, the longer the taper and

the more cones necessary to complete the project. For an interstate highway moving traffic at seventy miles per hour the minimum taper length is 840 feet using a minimum of thirty-three cones (FDOT, 1993).

The International Fire Service Training Association (IFSTA) is a non-profit educational association that creates training materials for the fire service. IFSTA manuals cover all facets of the industry from basic indoctrination of new personnel, to intricacies of the water production and delivery systems. They have become the standard training manuals in many departments throughout the country. In Fire Department Occupational Safety there is a chapter on “En Route Hazards and Response” which covers safety on roadways and limited-access highways. Several traffic scenarios are discussed and illustrated in the text. Traffic cones or other safety devices are not referenced at all and the safety of the motoring public is not addressed. This seems to be typical of the attention given to placing traffic work zone safety devices by the fire service. The main concern is for firefighter safety and protection of responders working on the highway.

One technique suggested in the IFSTA manual to

increase safety for emergency crews working on a highway is to park a second apparatus, with its emergency lights operating, behind the first arriving unit at a distance far enough from the first to act as a warning device and barrier between traffic and the first arriving apparatus (IFSTA, 1991). This can be effective if traffic doesn't move back into the blocked lane between the second unit and the working apparatus.

Safety of the motoring public is discussed in only one paragraph and it deals with the operation of emergency lights while responding on limited access highways, "Most warning lights on responding apparatus should be turned off when the apparatus enter the highway. Warning lights should be used at the scene" (IFSTA, 1991, pg. 220).

In his book, Safety and Survival on the Fireground, Vincent Dunn (1992), covers all area of fireground safety from incident command concerns all the way down to individual skills needed for safe operating techniques by firefighters.

Dunn devotes a whole chapter on dangers involved in responding to and returning from alarms. This chapter also covers working at incidents on roadways. Dunn

expects the police or highway patrol to handle this activity but does give some guidelines for placing warning devices behind the apparatus. While the type of warning device is not specified, he does go into detail about distances required for these devices to be effective. "Warning devices on a high-speed highway should be place at least 350 feet from the fire apparatus and positioned so that they are visible to a oncoming motorist for at least a further 350 feet before that" (Dunn, 1992, pg. 44). This hints at early warning for effective traffic control but does not elaborate on the theory or importance of the need for early warning.

In his article on effective traffic control for Emergency Product News, Steve Scarano (1977), discusses principles and techniques for moving traffic around emergency scenes. His background as a police officer, being responsible for the movement of traffic rather than handling a fire or accident victims, gives him a different perspective on working at a highway emergency scene. Although his article was written in 1977, the basic principles Scarano describe still work today. "Emergency traffic control should be regarded as a rescue function because it is a protective activity that serves

to separate the presently involved victims and rescuers from potential secondary harm” (Scarano, 1977, pg. 21). He recognizes the need for immediate action by rescue crews to protect themselves and the scene.

Scarano’s other basic, unchanged axiom is “The most important aspect of emergency traffic control is to ensure that the vehicle operators and pedestrians know exactly what you want them to do” (Scarano, 1977, p. 22). This is an early use of the principle of clear and positive direction given to motorists. To be effective you must get the motorist’s attention, then give him clear direction as to what needs to be done. This theme comes around again in the way he describes manually directing traffic and the setting up of warning devices.

The primary portable warning device, used at the time of this article, was the railroad flare which is still used today but not nearly as frequently. The diagrams in the article would work just as well with flares or cones. Scarano details a nice way of laying out unlit flares in a chain so they will be ignited successively in a chain increasing the continuous effective usage of these illuminating devices (Scarano,

1977).

In his article “Highway Incident Scene Safety” for Firehouse Magazine, Rich Adams (1992), combines the principles of early warning and positive guidance as the way to effectively move traffic away from the emergency scene and protect rescuers. “Once a driver is warned of a problem ahead, he must immediately be told what you want him to do” (Adams, 1992, pg. 14). One technique suggested is to place a second vehicle as far as half a mile before the accident to try to alert drivers and move vehicles to another lane. Again, this is only effective if traffic does not re-occupy the lane before seeing the emergency scene.

Another aspect of scene safety discussed was training all personnel how to “play in traffic” (Adams, 1992, pg. 14). This means knowing how to get in and out of the vehicle safely, setting up and removing warning devices correctly, facing traffic whenever possible, and staying out of travel lanes. These all seem to rather common sense type of things but they should be covered during training sessions (Adams 1992).

The original idea for adding cones to fire apparatus came from firefighters seeing them being used on utility

trucks. Both telephone and electric utility companies were contacted for information about their use of traffic cones. The electric utility was contacted by telephone and they said they had no standards for cone placement but positioning of vehicles and warning devices was covered in training. They would not elaborate on any safety matters or even how many cones were carried on each vehicle.

The local telephone company said that their standard operating procedures were proprietary in nature and could not be released. During the conversation they did say the telephone company had a manual and suggested procedures for work zones. The manual references the U. S. Department of Transportation MUTCD and uses many of the same standards for colors, sizes and warning distances and is specifically designed for guarding work areas. In relation to traffic cones the manual makes it clear that traffic cones are intended to guide traffic around a work area rather than act as a warning device and therefore must be used in conjunction with some type of warning sign. This is consistent with design of all work safety zones as described in DOT manuals and standards. What is not referenced is the familiar single

cone that is mounted on all telephone utility vehicles and placed on the ground every time the driver leaves the vehicle.

The Federal Highway Administration sponsors conferences on many topics dealing with the transportation industry. In December of 1994, one of the national conferences held in Washington D.C. dealt with the subject of Work Zone Safety. The three day conference had many workshops each day and covered all aspects of highway safety around work zones. The proceedings were published for all interested parties (FHA, 1994).

Dr. Nicholas J. Garber, whose comments were published, a professor of Civil Engineering at the University of Virginia, was one of the guest speakers at the conference. Dr. Garber covered the evolution and importance of work zone safety as chronicled in the MUTCD. The 1961 edition of the MUTCD was the first to specifically address work zone traffic controls. In 1971 the section on “Traffic Controls for Highway Construction and Maintenance Operations” became Part VI and was produced as a separate publication. Dr. Garber goes on to discuss the changes that have been made over the years

including: sizes, colors, philosophical changes and technical advances. According to Dr. Gerber, the most important of these is the philosophy of traffic control. Why do humans react the way the do when confronted with a change in the road conditions or hazards? “A major concern in this area is the ability to influence drivers to adhere to warning signs and instructions at work zones” (Gerber, 1994, pg. 23). The knowledge that comes from research on why people react in a certain way can then be converted to plans, procedures, and equipment that can modify drivers’ behavior in a way to safely move traffic around a hazardous area. Without the research into the human factors needed to mold drivers reactions, the engineering studies in colors, designs, and conspicuity will have little value in making the work zone a safer place (Gerber, 1994).

Speaking at the same conference was Joseph J. Lasek of the Federal Highway Administration. Mr. Lasek laid out four components that are the platform for a national program to improve work zone safety:

1. Standardization - Uniformity
2. Ensuring Compliance - Quality/Assurance
3. Evaluation - Information/Feedback/Direction

4. Innovative Technologies/Procedures - Adaptation/Education/Procedures (Lasek, 1994, pg. 53).

These items are being worked on currently and will become part of the next revision of the MUTCD. While this conference was created for the highway construction and maintenance industry, the principles of traffic movement are the same around a temporary emergency scene as they are for a construction zone. The major differences are the time involved in planning the work zone and the traffic patterns around it and the time available to set up and take down the warning and channelizing devices (Lasek, 1994).

The Federal Highway Administration published A Users Guide to Positive Guidance, which details techniques in signs, road markings, and channelization to safely move traffic. The concepts deal with normal traffic movement and the techniques and technologies available to accomplish this movement. The same principles apply to emergency areas but the positive guidance must be done with portable devices. Part of the problem with working an emergency scene is the lack of early warning for motorists.

Positive guidance is a concept of traffic control, “based on the premise that drivers can be given sufficient information about a hazard where they need it and in a form they can use to enable them to avoid an accident” (U.S. DOT, 1981, pg. 1-3). The book also stresses the planning involved in producing this positive guidance. In the temporary emergency work zone, the planning is often non-existent. This is an area where preplanning is necessary, especially on interstate highways and other roads where major accidents can be anticipated. This preplanning can come in the form of using existing traffic control devices, stock piling portable devices in a certain area, or adding traffic control devices to units normally involved in highway incidents. These physical assets, combined with awareness and training about handling emergencies in traffic areas, will go a long way in preventing problems in highway work zones (U.S. DOT, 1981)

In an article in Better Roads, Lori Erlandson (1997), stresses training for workers and educating the public as the way to reduce dangers in the work zone. In the fire service the traditional training has been to protect the emergency worker from the motorist.

Erlandson turns this philosophy around by saying protect the motoring public from the work zone. Make the work zone safe for the motoring public and it will be safe for the workers. “Getting the attention of drivers before they enter work zones is important” (Erlandson, 1997, pg. 32). Warn the motorist that there is a problem ahead. Early warning is the key. Give them a clear message, one that can be understood by all and is not confusing. Give them positive guidance, eliminate choices and visually show them the correct way to drive through the work zone (Earlandson, 1997).

PROCEDURES

Research Methodology

The first literature search was initiated at the Learning Resource Center at the National Emergency Training Center during the third week in September of 1997. While there was a wealth of information relating to traffic safety for the public and fire apparatus operators, there was almost nothing related to fire departments setting up work zones or traffic cones while at emergency scenes. There were several Executive Fire

Officer research papers relating to standard operating procedures for apparatus operators which had limited information about scene safety and traffic cones.

This lack of fire service literature directly related to vehicle accident scene safety led to the exploration of utility company and department of transportation guidelines for setting up temporary work zones on highways. The research then shifted to highway maintenance and construction industry literature.

The Boca Raton Fire-Rescue Department participated in a meeting, arranged by the city safety officer, that included a Florida Department of Transportation representative, dealing with traffic cones that led to a city-wide task force to study highway work zone safety and recommend procedures for safety zones to be used by all departments within the city. This task force suggested publications and areas for research.

A survey instrument was created to gather information about the way fire departments carry and use devices to mark accident scenes. Several questions, that related to visibility of personnel and equipment, were included after initial research indicated that high visibility was a key factor in scene safety.

The survey was pilot tested by sending a copy to several local executive fire officer students and a neighboring city for their review, with the intent of finding errors or ambiguities. Several changes were made as a result of review, including eliminating an ambiguous question and changing the position of response area. A copy of the survey is attached in Appendix A.

Population of the Survey

The survey was mailed to ninety-five individuals. Surveys were sent to all departments in the three large counties in south Florida and various departments throughout the country. The list was created with the help of the Florida Fire Chief's Association mailing list and class rosters of the last three executive fire officer classes attended by the author. The last of the returns came in six weeks after the original mailing.

The questionnaire enclosed in the survey had two questions about high visibility material worn on uniforms or vests while working in proximity to a highway. Two questions dealt with limited access highways. Two questions related to devices used to mark a work zone and two others dealt with the standard operating procedures and training for the use of these devices. The last

question was a request for a copy of the standard operating procedure if one was in effect. The raw data was accumulated and is listed in Appendix B.

Assumption and Limitations

It is assumed that the surveys were routed to the person in the organization with the proper knowledge to complete the survey and that all respondents answered the questions completely and truthfully. The distribution of the survey was not designed to create a statistically accurate random sample. The surveys were distributed to all local fire departments to determine what was the norm for the geographical area. Other surveys were sent to past and present Executive Fire Officer students to ensure a high percentage of returns knowing that these individuals would be more inclined to respond and share information. This sample type will offer comparison information but will not yield a scientific result about what can be projected nationwide.

The survey was limited to fire service organizations. A wider survey population could have included state departments of transportation, large highway construction companies, and branches of the United States military. While not fire service related,

that information could have been used for bench marking.

Due to the lack of fire service related literature on the subject, the literature search was expanded to other related highway publications for a better understanding of the total highway work zone atmosphere.

RESULTS

Surveys were mailed out to ninety-five individuals and seventy-four percent were answered and returned over a six week period.

The first question about reflective material was designed to determine if departments used some high visibility material on station work uniforms in the event personnel are working on roadways without any other type of reflective garment. Seventy-seven percent of the respondents did not use reflective material on their uniforms. The second question also related to the visibility of personnel working in the roadway. Fifty percent of the departments had their personnel wearing a reflective safety vest while working in the roadway.

Seventy-six percent of the survey respondents did have an interstate highway in their jurisdiction.

Twenty-five percent of those who had an Interstate highway had specific standard operating procedure for those limited access highways as opposed to local roadways.

The sixth question relates to the type of traffic control assistance a department receives while working a roadway. Eighty-one percent of the respondents have some type of aid in traffic control with most citing the state highway patrol for interstate highways and local police or sheriffs helping out on local roadways.

The seventh and eighth questions were the heart of the survey. What devices are the departments using to mark the work zone and how many of each were they carrying? Question seven gave the respondent four choices. Twenty-seven percent of the departments are still using some type of flare for roadway marking. Fifteen percent are using triangular reflectors. The majority, seventy-five percent, use traffic cones although the size or type was not specified. The last category was “other” in which twenty-one percent of the respondents answered emergency lighting on the fire apparatus.

The next question focused on the number of each

device carried and, specifically the number of traffic cones, was calculated to find the average number carried on a vehicle. Of the fifty-three departments who carry traffic cones, the average number carried was five.

The next question dealt with the training on deploying and using the marking devices. Answers were varied but the majority of the respondents to the question, thirty-two percent, said “none”.

The last two survey questions related to standard operating procedures for placement of the devices. Seventeen departments had standard procedures and fifteen include them with the returned survey.

The survey shows that all departments carry some type of warning devices. The review of the SOPs that were returned shows that these devices are not being used in the manner suggested by traffic engineers. Only a few respondents were using traffic cones for tapers.

The survey answered the third research question relating to how many cones should be carried on each apparatus. There was no specification or standard in the literature for quantity of cones and the answer derived from the survey is five.

The literature review began at the Learning

Resources Center at the National Emergency Training Center but lacked the depth expected from the fire service sources. Because the scope of the research was very narrow, focusing on a solution for a small issue, the direct approach, looking for the topic of traffic cones, yielded little. Researching standard operating procedures for apparatus operators and ambulance drivers was somewhat successful but again limited due to a great amount of material generated on driving as opposed to very little information on scene protection after arrival.

The best information came from the road construction and maintenance industry who has a body of research and literature on the reaction of the motoring public to disturbances in normal traffic patterns. Traffic engineers have been studying ways to move vehicles more efficiently for decades and recently an emphasis has been put on reconstruction, widening and maintenance as traffic volumes expand and new road construction decreases. The major axioms of work zone safety for the worker and the motorist are early warning, clear direction and positive guidance.

The exact specifications for traffic cones comes

from a combination of manuals that deal with traffic control devices. The MUTCD and the FDOT manual detail exactly what is required and, in brief, the cone needs to be; fluorescent orange, thirty-six inches tall, weigh 12 pounds, and have two white retroreflective collars if they are to be used at night.

The NFPA standards relating to traffic cones comes from the health and safety section. They do not address the cones themselves or the quantity to be carried. They do require that some type of device, like flares or traffic cones, be used to warn oncoming traffic of the emergency ahead.

The question of how many cones should be carried on a vehicle was not addressed in any of the emergency response literature. The highway construction and DOT information indicates that tapers for moving traffic from one lane to another requires cones to be spaced at different intervals and in different lengths depending on the with of the lanes and speed of the traffic. A minimum of five cones is required for short tapers on low speed roadways. The survey indicates an average of five cones being carried on fire apparatus in the local area and at the selected departments around the country.

DISCUSSION

The survey of fire departments reflects much the same attitude about traffic cones specifically and highway work zone safety in general as the fire service literature. The fire service is very concerned about safety of fire service personnel but doesn't treat highway work zone safety with the same urgency as personnel accountability, respiratory protection, and hazardous materials, even though firefighters are working out on the highway far more than these other applications. The attitude in the literature and the survey indicates that creating safety for the worker is very important, but safety of the motoring public is not even mentioned.

The highway construction and maintenance industry has been working on occupied roadways for decades. Their experience and professional engineering resources have created devices and methods to protect drivers and workers alike. This body of knowledge can be transferred to emergency services as they set up temporary work zones to handle emergencies.

Federal and State Departments of Transportation have all the necessary specifications and, in many cases, will

help provide equipment and training for emergency service personnel to purchase and effectively use traffic control devices. The fire service needs to use resources to increase awareness of the firefighters and outfit them with the tools necessary to do the task effectively. The perception also needs to change in the fire service so that the motoring public is protected first from the hazard that is caused by working a highway scene. By safely guiding traffic around the emergency, the work zone will be a safer place.

The challenge for emergency services is to recognize the need to create a highway work zone and dedicate the time and resources to accomplish the job. Seeing the big picture of work zone safety is far more important than knowing how big a cone should be and how many should be carried.

The key for Boca Raton Fire-Rescue and many other emergency services will be to change the perception of our own personnel about working in the highway. No emergency personnel should be working in the road without high-visibility, retroreflective garments. No work should begin without some type of scene protection and, when the second unit arrives, a safety zone should be

established with early warning and positive guidance for the motorist.

RECOMMENDATIONS

There are six main recommendations for Boca Raton Fire-Rescue that come from this research.

First, and most basic, is to place five cones on each fire apparatus. The department will assure the specifications for these cones meets the night and day requirements of the FDOT. Space and weight constraints are key factors in determining the number. By placing the cones on the tailboard they are easily accessible and can be placed by the apparatus operator. More than five would be difficult to carry and deploy, while five is a minimum number necessary to create a short taper.

Second, the Department will create a section in the standard operating procedure for handling emergencies on highways to include setting up temporary work zones which will include early warning, positive guidance and deployment of cones and flares.

Third, the Department will hold training sessions for all personnel in the theory of work zones and the

importance of early warning and set-up of the devices. This training will attempt to change the old perceptions of the fire service and create the need for firefighters to safely guide traffic around the work zone.

Fourth, the Department will research arrow boards for fire apparatus. This basic device for early warning may be able to be mounted in a way that it can be folded up and activated upon arrival at an emergency, then folded down over the hose bed for normal driving.

Fifth, Boca Raton Fire-Rescue has a fleet of eight ambulance type vehicles that can be retrofitted with arrow markers on the back of the vehicles above the double back doors. These arrow markers could be activated for right or left side passing and add to the early warning for motorist.

Sixth, the Department often responds a Battalion Chief and an Emergency Medical Services supervisor to many scenes. Their vehicles can also be outfitted with an arrow bar to be used as an early warning device when parked at a distance behind working emergency vehicles.

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APPENDIX A

November 15, 1997

Dear Chief,

Boca Raton Fire-Rescue is researching ways to improve our safety measures while operating at emergency scenes located on roadways. We currently wear reflective vest to help identify our personnel and traffic cones to help designate our apparatus.

We are asking for assistance with information about your departments safety measures at alarms such as motor vehicle accidents on or near roadways including interstate highways. This information will also be used as data for a research paper in the Executive Fire Officer Program at the National Fire Academy.

Please take a few moments to fill out this short questionnaire and return it in the self addressed, stamped envelope enclosed. Thank you.

Sincerely,

John D. Eddinger, Asst. Chief
Operations Division

Enclosures: survey and envelope

This survey deals with the way Fire Departments operate while working on or near roadways. Specifically, what types of reflective, warning, and marking devices are used to designate the work zone when handling motor vehicle accidents and similar situations on roadways. Please circle the correct response and add any comments you feel appropriate.

Department name: _____

Does your department use any type of reflective material on station work uniforms.
YES NO

Does your department use high visibility vest while working on or near roadways.
YES NO

Does an Interstate Highway run through you jurisdiction? YES NO

Does your department use any different techniques or SOPs to identify fire apparatus or designate the work zone while working on the Interstate Highways as opposed to other roadways. YES NO

If YES, what is different?
_____

Does your department use another unit or agency to protect emergency operations personnel while they operate on or near a highway.
YES NO

During emergency operations what devices does your department use to mark fire apparatus parked on or next to the road.
Flares Triangular reflectors Traffic cones Other _____

How many of each device does your department carry?

What kind of training do you provide for using these devices? _____
_____
_____
_____

Does your department have a Standard Operating Procedure for placement of these devices. YES NO

If possible, enclose a copy of your SOP for placement of apparatus and placement of the marking devices when working on or near roadways. Thank you.

APPENDIX B SURVEY RAW DATA TOTALS

95 surveys mailed - 71 returned

Does your department use any type of reflective material on station work uniforms?
YES 16 NO 55

Does your department use high visibility vest while working on or near roadways?
YES 35 NO 35

Does an Interstate Highway run through your jurisdiction?
YES 54 NO 19

Does your department use any different techniques or SOPs to identify fire apparatus or designate the work zone while working on the Interstate Highways as opposed to other roadways?
YES 16 NO 48

Does your department use another unit or agency to protect emergency operations personnel while they operate on or near a highway?
YES 58 NO 13

During emergency operations what devices does your department use to mark fire apparatus parked on or next to the road?
Flares 19 Triangular reflectors 11
Traffic cones 53 Other 15

How many of each device does you department carry?
Traffic cones 6, 4, 5, 4 to 6, 4, 10, 5 to 6, 3, 3 to 5, 4, 4, 3, 6, 3, 6, 3, 1, 1, 2, 6, 6, 4 to 6, 4, 4, 6 to 10, 3, 4, 3, 3 to 5, 4 to 6, 3, 4, 2, 12, 8 to 10, 5, 4, 2 to 6, 8, 2, 4, 6, 4, 5, 5, 4, 2, 4, 4, 3.

What kind of training do you provide for using these devices?
None 23

Does your department have a Standard Operating Procedure for placement of these devices?
YES 17 NO 50

If possible, enclose a copy of your SOP for placement of apparatus and placement of the marking devices when working on or near roadways.

15 Departments enclosed a standard operating procedure.